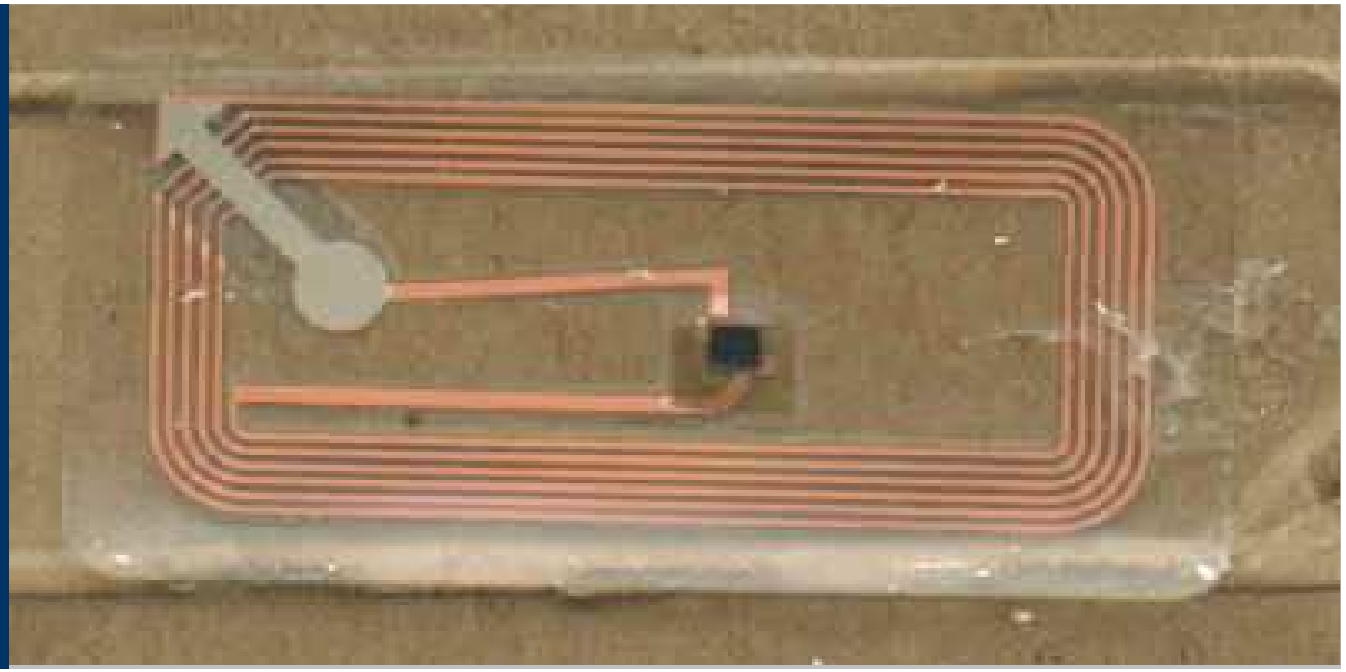

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Introduction to RFID

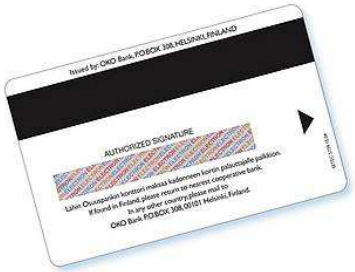
(WS 05/06)

TECHNISCHE UNIVERSITÄT DARMSTADT

Brief History

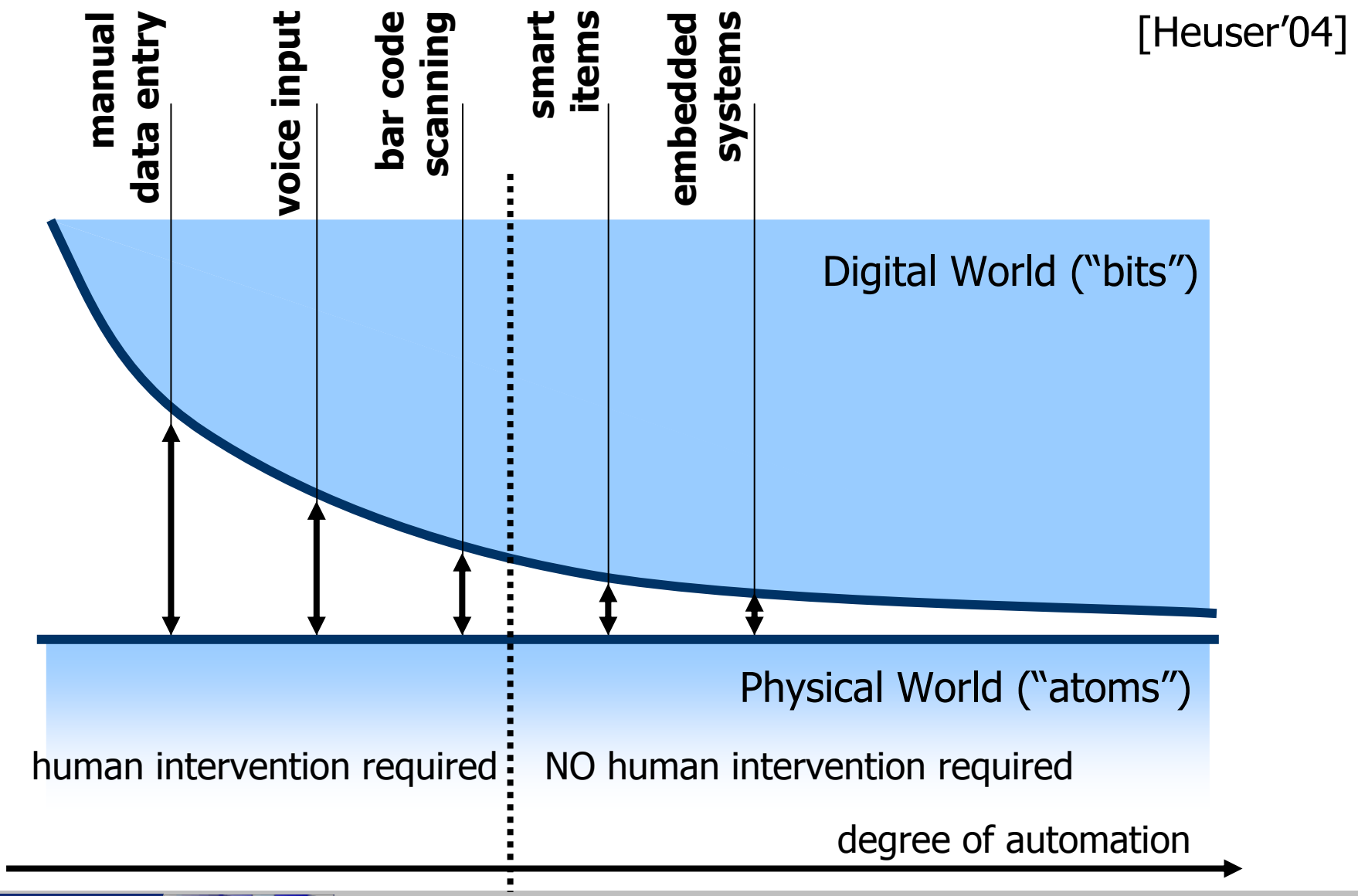
- **Automatic Identification (Auto-ID) and Data Collection (AIDC) Technologies**

- **Ubiquitous:**
  - **Supermarket**
  - **Credit/Bank/ID Cards**
  - **Car Keys**



- **How Old Are These Technologies?**
  - **1930’s, 40’s: Magnetic Stripes**
  - **1950’s, 70’s: Bar Codes, UPC**
  - **1949…: Radio Frequency ID**

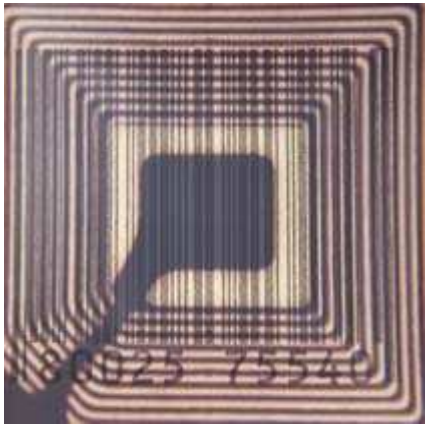
Physical and Digital Worlds



RFID Systems

- An AIDC Technology using Radio Frequency:
  - RFID Tags
    - Chip for Holding Data
    - An Antenna
  - RFID Readers
  - Radio Waves Characteristics
  - Computer Network (if any)
- Many Types of Tags
  - Active / Passive / Semi-passive
  - Read / Write
  - Various Frequencies

RFID Tags



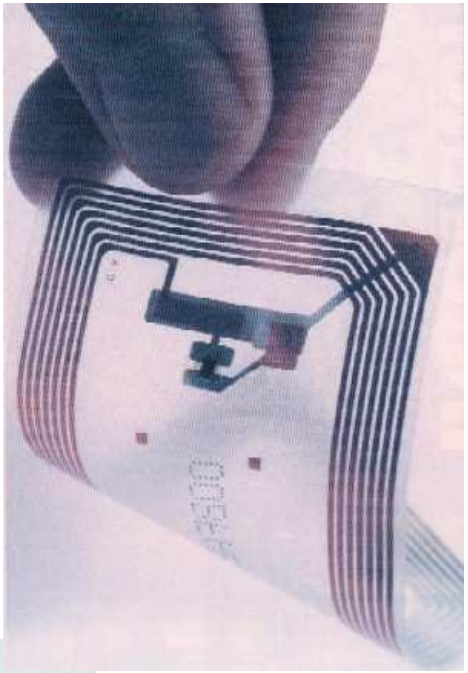
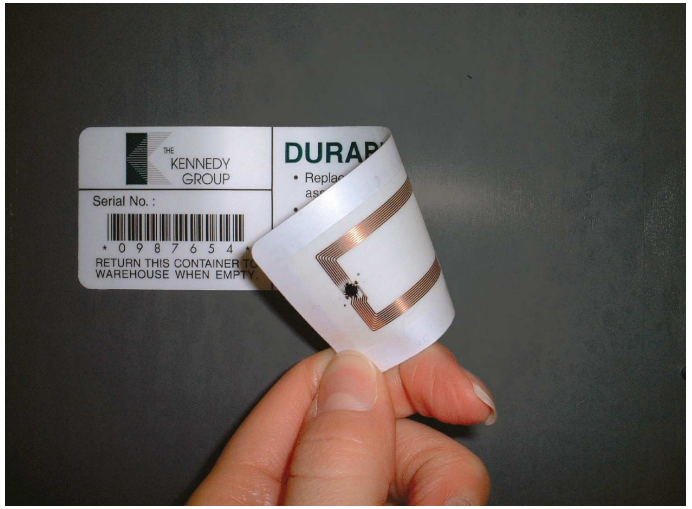



image source: Hitachi


KENNEDY
GROUP
Serial No. :
RETURN THIS CONTAINER
WAREHOUSE WHEN EMPTY

RFID – Basic Idea

labeling

- ***code*** **(unique identifier) is stored in a RFID Tag**
- **Tag is attached to a product**
- **Product becomes now unique identifiable**

use

- **Product transmits *code* from the embedded tag (active tag)**
- **Reader gets the message (*code*)**
- ***code*** **needs to be processed**
  - **corresponding action(s) to be taken here**

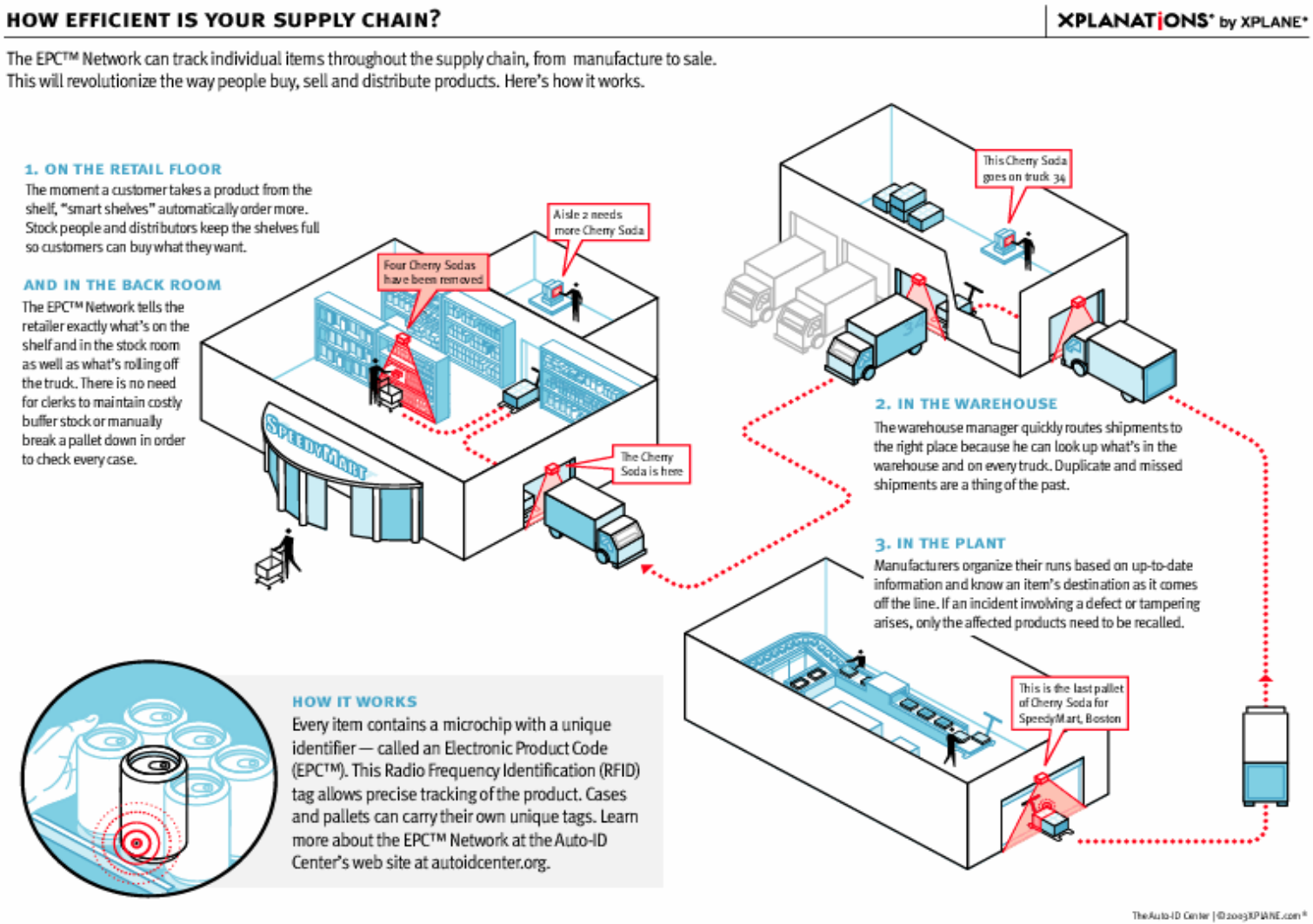
RFID - Use Cases

- Badges/Smart keys
  - Grant or deny access
- Agriculture
  - Livestock Tracking
- Toll roads
  - Tracking and charging
- Asset Management
- Maintenance
  - Aircraft – Intelligent Toolbox
  - Equipment - Record/db on Tag
- Supply Chain Mgmt
  - Inventory control
  - Logistics

RFID – Supply Chain Mgmt

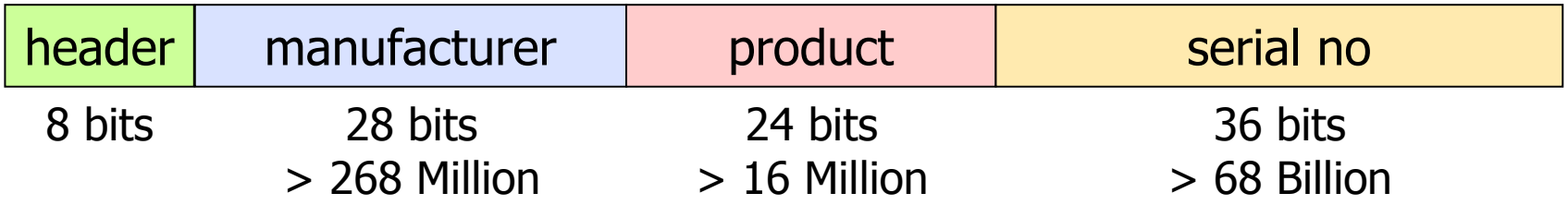
- Innovate ways to identify, locate and monitor goods as they travel through the supply chain of many industries
- First Benefits
  - Increase accuracy of orders
  - Reduce inventory handling cost
    - Improve inventory handling
  - Fewer misplaced items (in warehouse)
  - Reduce losses from theft (ca. $31 Bi in 2002)

RFID – Supply Chain Mgmt (cont)



EPCglobal Network

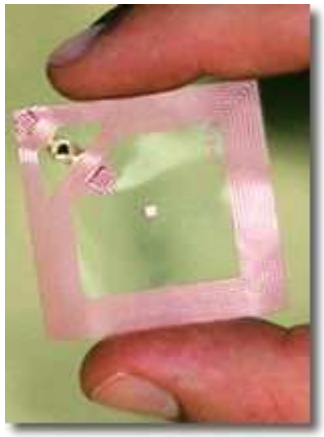
- **Based on 5 Main Pillars:**
  - **Electronic Product Code (EPC)**
  - **ID System**
  - **EPC Middleware**
  - **Discovery Services**
  - **EPC Information Services (EPC IS)**
- **EPC:**
  - **Unique “object” identifier (worldwide)**
  - **96-bit number**
  - **Extension of the Universal Product Code (UPC)**

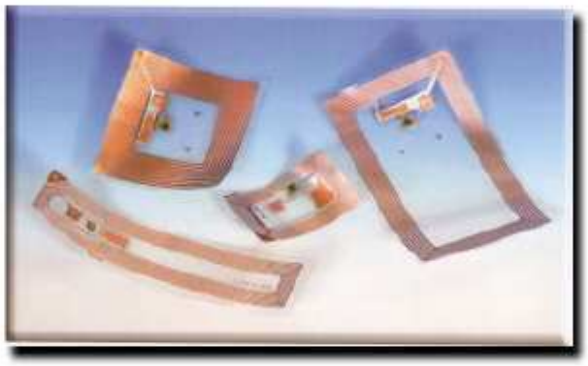


EPCglobal Network (cont)

- ID System
  - EPC Tags
  - EPC Readers
- EPC Middleware
- Discovery Services
  - Object Naming Service (ONS)
- EPC Information Services

RFID – More Pictures





RFID – Some Challenges

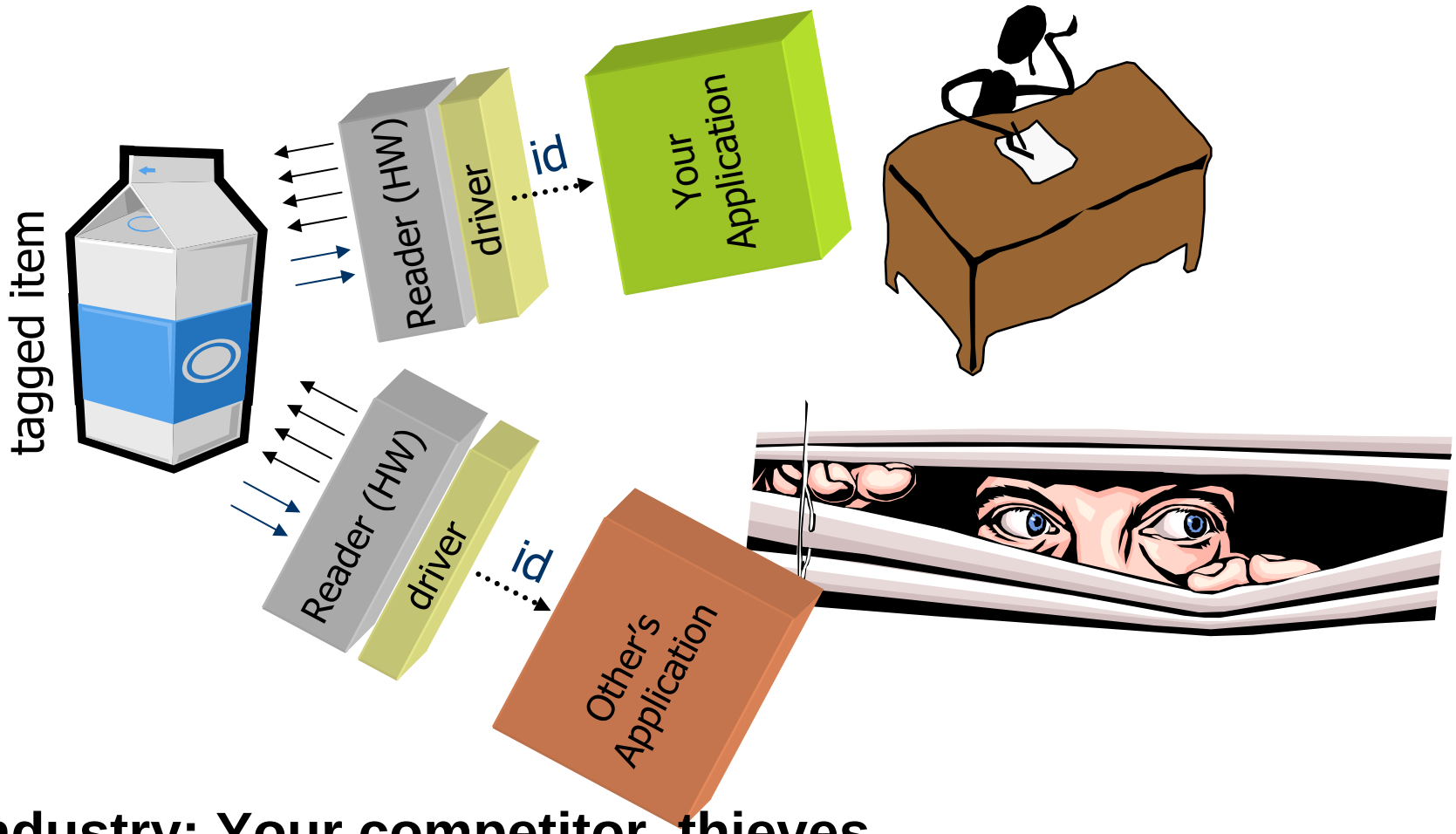
- Reduce Tag Prices (5 Cent Initiative)
- IT Infrastructure
  - Data Processing
    - Online Handling of Huge Amounts of Streaming Data
    - Storage, Network Bandwidth & Systems
  - Integration
    - DBs, Data Warehouses and Enterprise Apps
- Global Standards
  - Frequency of Tags & Readers
    - USA, Europe and Japan using Different Frequencies

RFID – Privacy Concerns

From Consumers' Perspective:

- They are not well informed
- Unclear reason for its usage
- Companies usually have low credibility
  - They could have something to hide
- Laws do not really protect people against misuse
- Secure technology?
  - Enough experiments?

RFID – Privacy Concerns (cont)



Industry: Your competitor, thieves, …

End Consumer: companies trying to profile you, thieves

RFID - Summary

- Efficiency, Convenience
- Anti-Counterfeiting and Tampering
- Trend: Integration of Physical and Digital Worlds
- Understand (on Field) the Problem and then Select Appropriate Solution
- Read and Write Capability
  - Portable Database
- Uniquely Identify Every Physical Object

Thank you! ;^)